RAYTHEON

TECHNICAL INFORMATION SERVICE

Technical Information

CK6080WA

RELIABLE TWIN POWER TRIODE

The CK6080WA is a reliable, heater-cathode type, low-mu, twin power triode, suitable for operation as a regulator tube in DC power supplies. It is designed for service where conditions of high temperature and mechanical shock or vibration are encountered. Several CK6080WA tubes can be paralleled as desired for increased levels of current or power.

MECHANICAL RATINGS:

Maximum Impact Acceleration (Shock) .... 450 G
Fatigue (Vibrational Acceleration for extended periods) .... 2.5 G
Maximum Bulb Temperature .... 230 °C
Altitude (Note A) .... 60,000 ft.

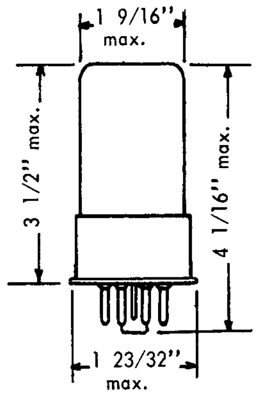
ELECTRICAL DATA

Ratings and Normal Operation	MIL–E–1 Symbol	Test Limit or Absolute Minimum	Normal Test Conditions	Normal Operation	Test Limit or Absolute Maximum	MIL–E–1 Units
			Ratings			
Heater Voltage	Ef:	6.0	6.3	---	6.6	V
Plate Voltage	Eb:	---	135	---	250	Vdc
Grid Voltage	Ec:	---	0	---	0	Vdc
Heater-Cathode Voltage (Note B)	Ehk:	−300	---	---	+300	v
Cathode Resistance (per cathode)	Rk/k:	---	250	---	---	Ohms
Grid Resistance (per grid) Note C	Rg/g:	---	---	---	---	Meg.
Grid Current (per grid)	Ic/g:	---	---	---	5.0	mAdc
Plate Dissipation (per plate)	Pp/p:	---	---	---	13	W
			Tests			
Heater Current	If:	2.35	---	---	2.65	A
Heater Cathode (Leakage −(Ehk = ±100 Vdc) Note D	Ihk:	---	---	---	25	μAdc
Plate Current (Notes D, E)	Ib:	100	---	125	150	mAdc
Transconductance (Notes D, E)	Sm:	6,000	---	7,000	8,200	μmhos
Transconductance (2) (Notes D, E) Ef = 5.7V	Δ_{Ef}Sm:	---	---	---	10	%
Plate Current (1) difference between sections	ΔIb:	---	---	---	25	mAdc
Amplification (Notes D, E)	Mu:	1.5	---	---	2.5	---

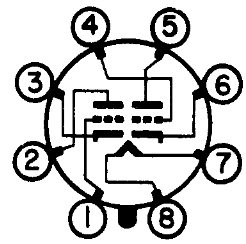
MECHANICAL DATA

ENVELOPE ....T–12 Glass
BASE B8–98
CATHODE ...Coated Unipotential
BASING 8BD
MOUNTING POSITION ......Any

PHYSICAL DIMENSIONS



BASING



BOTTOM VIEW

TERMINAL CONNECTIONS:

Pin 1 Grid, Unit #2
Pin 2 Plate, Unit #2
Pin 3 Cathode, Unit #2
Pin 4 Grid, Unit #1
Pin 5 Plate, Unit #1
Pin 6 Cathode, Unit #1
Pin 7 Heater
Pin 8 Heater

RELIABLE TWIN POWER TRIODE

Ratings and Normal Operations	MIL–E–1 Symbol	Test Limit or Absolute Minimum	Normal Test Conditions	Normal Operation	Test Limit or Absolute Maximum	MIL–E–1 Units
			Tests			
Vibration (2) Rp=2000; Ec= -7 Vdc (Note F) Rk=0; f=25 cps; G=2.5	Ep:	---	---	---	50	mVac
Plate Current (2) Eb = 250 Vdc; Ec = – 200 Vdc (Notes D, E)	Ib:	---	---	---	10	mAdc

SPECIAL TESTS AND RATINGS TO INSURE RELIABILITY.

Randomly selected statistical samples are subjected to the following tests:

Shock Test –	450G. 30° hammer angle in Navy high impact shock machine. Sample subjected to twenty impact accelerations, five impact accelerations in each of four different positions.
Fatigue Test –	2.5G. Sample subjected to vibrational acceleration of 2.5G for 96 hours (32 hours in each of three positions). The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.
Heater-Cycling Life Test –	A sample is subjected to 2000 on–off heater cycles at the following conditions. Ef=7.5 V; Ehk=300 V and other elements floating. At the conclusion of this test the tubes will not show open heater or cathode circuits, heater-cathode shorts, or heater-cathode leakage current in excess of 50μAdc.
Stability Life Test –	Sample is operated for one hour to assure initial electrical stability (Δ_t Sm < 10%). Tubes operated at room temperature ambient, Rl =125 Ω Rg/g = 1.0 meg; Ehk = 300 V.
Survival Rate Life Test –	Sample is operated one hundred hours to assure electrical stability (Sm > 5800 μmhos) and freedom from inoperatives, at stability life test conditions.
Intermittent Life Test –	1000 hours. Sample is operated with minimum Envelope Temperature of 230°C. Tubes are operated at Rk = 125 ohms; Rg = 1.0 meg.; Ehk = 300V.
Altitude –	Sample is subjected to a pressure of 55±5 mmHg (60,000 ft.) at 500 Vac to assure freedom from flashover or corona at the pins of the tube.

APPLICATION NOTES

CAUTION – –**To Electronic Equipment Design Engineers**: Special attention should be given to the temperature at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy may be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are closely related to the degree that regulation of the heater voltage is maintained at its center rated value.

Note A If altitude rating is exceeded, reduction of instantaneous voltages (Ef, excluded) may be required.

Note B The reference point for heater-cathode potentials shall be the positive terminal of the cathode resistor.

Note C Maximum grid-circuit resistance:

(a) 1.0 megohm for Cathode-bias operation.
(b) 0.1 megohm for fixed-bias operation.
(c) 0.1 megohm for combined fixed and cathode-bias operation.

Note D Test each unit separately.

Note E Both units shall be operating.

Note F Tie 1k to 2k; 1g to 2g; and 1p to 2p.

ACCEPTANCE CRITERIA

The following tests shall be performed:

For the purposes of inspection, use applicable reliable paragraphs of MIL–E–1.

For miscellaneous requirements, see Paragraph 3.6.

TEST CONDITIONS

Heater Voltage	6.3 V
Plate Voltage	135 Vdc
Grid Voltage	0 Vdc
Cathode Resistance (per cathode)	250 ohms

Ref.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Symbol	LIMITS (See Note 2)						Units
						Min	LAL	Bogie	UAL	Max	ALD	
QUALIFICATION APPROVAL TESTS (Note 19)												
3.1	Qualification Approval:	Required for JAN Marking	---	---								
4.9.20.3	Vibration (1):	Ec1 = – 7Vdc; Rp = 2000 ohms; (note 13)	---	---	Ep:	---	---	---	---	100	---	mVac
---	Cathode:	Coated Unipotential	---	---								
3.4.3	Base Connections:	B8–98	---	---								
MEASUREMENTS ACCEPTANCE TESTS, PART 1 (Note 1)												
4.10.8	Heater Current:		0.65	II	If:	2.35	---	---	---	2.65	---	A
4.10.15	Heater-Cathode Leakage:	Note 12 Ehk = + 100 Vdc Ehk = – 100 Vdc	0.65	II	Ihk: Ihk:	--- ---	--- ---	--- ---	--- ---	25 25	--- ---	μAdc μAdc
4.10.6.1	† Grid Current:	Rg = 1.0 Meg.; Rk = 125 ohms; (notes 5, 13)	0.65	II	Ic:	0	---	---	---	–2.0	---	μAdc
4.10.4.1	Plate Current (1):	(notes 12, 15)	0.65	II	Ib:	100	---	---	---	150	---	mAdc
4.10.4.1	Plate Current (1):	(notes 2, 12, 15)	---	---	Ib:	---	115	125	135	---	25	mAdc
4.10.9	Transconductance (1):	(notes 12, 15)	0.65	II	Sm:	6000	---	---	---	8200	---	μmhos
4.10.9	Transconductance (1):	(notes 2, 12, 15)	---	---	Sm:	---	6600	7000	7400	---	1000	μmhos
4.7.5	Continuity and Shorts: (Inoperatives)		0.4	II		---	---	---	---	---	---	
4.9.1	Mechanical:	Envelope: per outline	---	---		---	---	---	---	---	---	

Ref.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Symbol	LIMITS (See Note 2) Min	LAL	Bogie	UAL	Max	ALD	Units
MEASUREMENTS ACCEPTANCE TESTS, PART 2												
4.8	Insulation of Electrodes:	Eg-all = − 100 Vdc Ep-all = − 300 Vdc (note 12)	2.5	L6	R: R:	200 200	--- ---	--- ---	--- ---	--- ---	--- ---	Meg Meg
4.10.9	Transconductance(2):	Ef = 5.7V; (notes 12, 15)	2.5	I	$\Delta \frac{Sm}{Ef}$:	---	---	---	---	10	---	%
4.9.12.1	Low Pressure Voltage Breakdown:	Pressure = 55 ± 5 mm Hg; Voltage = 500 Vac; (notes 3, 4)	6.5	Note 4	---	---	---	---	---	---	---	
4.10.4.1	Plate Current (1) Difference Between Sections:		2.5	I	Ib:	---	---	---	---	25	---	mAdc
4.10.11.1	Amplification Factor:	Rk = 250 ohms (notes 12, 15)	6.5	Code G	Mu:	1.5	---	---	---	2.5	---	
4.9.19.1	Vibration (2): (Low Frequency)	Rp = 2000; Ec = −7Vdc; (note 13)	6.5	Code G	Ep:	---	---	---	---	50	---	mVac
4.10.4.1	Plate Current (2):	Eb= 250 Vdc; Ec = −200 Vdc; (notes 12, 15)	2.5	I	Ib:	---	---	---	---	10	---	mAdc
DEGRADATION RATE ACCEPTANCE TESTS, NOTE 7												
4.9.20.5	Shock:	Hammer angle = 30° Ehk = + 100 Vdc; Ec = −7 Vdc; Rb = 2000 ohms; Rk = 0; (notes 13, 20)	---	---	---	---	---	---	---	---	---	
4.9.20.6	Fatigue:	G = 2.5 min. Fixed Frequency; F = 25 min. 60 max. Apply only Ef.	6.5	Note 4		---	---	---	---	---	---	
---	Post Shock and Fatigue End Points:	Vibration (2)	---	---	Ep:	---	---	---	---	100	---	mVac
		Heater-Cathode Leakage Ehk = + 100 Vdc	---	---	Ihk:	---	---	---	---	50	---	μAdc
		Ehk = − 100 Vdc	---	---	Ihk:	---	---	---	---	50	---	μAdc
		Change in Transconductance (1) of individual tubes.	---	---	Δ_t^{Sm}:	---	---	---	---	10	---	%
		Grid Current:	...	---	Ic:	---	---	---	---	−3.0	---	μAdc

Ref.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Allowable Defectives per Characteristic: First Sample	Combined Sample	Sym.	LIMITS Min	Max	Units
ACCEPTANCE LIFE TESTS, NOTE 7										
4.11.3.1(a)	Stability Life Test:	Rk=125; Rg/g=1.0 Meg Notes 10,11,13 Ehk=300V								
4.11.4	Stability Life Test End Points: (1 hour)	Change in Transconductance(1) of individual tubes; Note 10	1.0	Code I			Δ_tSm:	---	10	%
4.11.3.1(b)	Survival Rate Life Test:	Notes 11,13,14,17 Stability Life Test Conditions or Equivalent								

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Ref.	Test	Conditions	AQL (Percent Defective)	Inspection Level or Code	Allowable Defectives per Characteristic		Sym.	LIMITS		Units
					First Sample	Combined Samples		Min	Max	
ACCEPTANCE LIFE TESTS, NOTE 7 (Cont'd)										
4.11.4	Survival Rate Life Test End Points: (100 hours)	Inoperatives	0.65	II						
		Transconductance(1)	1.0	II	---	---	Sm:	5800	---	µmhos
4.11.7	Heater Cycling Life Test:	Ef=7.5V;Ehk=300Vdc; Eb=Ec=0; Note 8 1 min. on, 4 min. off								
4.11.4	Heater Cycling Life Test End Points:	Heater-Cathode Leakage								
		Ehk=+100Vdc	---	---	---	---	Ihk:	---	50	µAdc
		Ehk=−100Vdc	---	---	---	---	Ihk:	---	50	µAdc
		Note 8								
4.11.5	Intermittent Life Test	Rk=125 ohms; Rg=1.0 meg; Ehk=300V; T Envelope=230°C min.; Notes 9,13,16	---	---	---	---		---	---	
4.11.4	Intermittent Life Test End Points: (1000 hours)	Notes 6,16								
		Inoperatives; Note 18	---	---	1	3		---	---	
		Grid Current	---	---	1	3	Ic:	0	−10	µAdc
		Transconductance(2)	---	---	1	3	ΔSm/ΔEf:	---	10	%
		Combined Defectives			2	5				
		Heater-Cathode Leakage								
		Ehk=+100Vdc	---	---	1	3	Ihk:	---	25	µAdc
		Ehk=−100Vdc	---	---	1	3	Ihk:	---	25	µAdc
		Heater Current	---	---	1	3	If:	2.35	2.75	A
		Transconductance(1)	---	---	1	3	Sm:	5500	---	µmhos
		Insulation of Electrodes								
		g—all	---	---	1	3	R:	100	---	Meg
		p—all	---	---	1	3	R:	100	---	Meg
		Combined Defectives			3	6				
PACKAGING REQUIREMENTS										
4.9.18.1.1	Carton Drop:	(d) Package Group 1; Carton Size F								

Note 1: The AQL for the combined defectives for attributes in Measurements Acceptance Tests, Part 1, excluding Inoperatives and Mechanical shall be one (1) percent. A tube having one (1) or more defects shall be counted as one (1) defective. MIL–STD–105, Inspection Level II shall apply.

Note 2: Variables Sampling Procedure: See 4.1.1.7

Note 3: Low pressure voltage breakdown.- Tubes shall be tested in a chamber under the pressure specified. The specified voltage shall be applied between the base pins (or leads) of elements carrying B+ voltage and their adjacent pins (or leads). The voltage shall be of sinusoidal waveform with F = 60 cycles. Tubes showing evidence of arcing or corona shall be considered as defectives.

Note 4: This test shall be conducted on the initial lot and thereafter on a lot approximately every 30 days. Once a lot has passed, the 30-day rule shall apply. In the event of lot failure, the lot shall be rejected and the succeeding lot shall be subjected to this test. MIL–STD–105, sample size code letter F shall apply.

Note 5: With both units operating, Ic is the sum of I1c and I2c.

NOTES: (Cont'd)

Note 6: Order for Evaluation of Life Test Defects.- See 4.11.3.1.2.

Note 7: Destructive tests: Tubes subjected to the following destructive tests are not to be accepted under this specification.
- 4.9.20.5 Shock.
- 4.9.20.6 Fatigue
- 4.11.7 Heater-Cycling Life Test.
- 4.11.5 Intermittent Life Test.

Note 8: The no load to steady state full load regulation of the heater voltage supply shall be not more than 3.0 percent. This test shall be made on a lot by lot basis. A failure or defect shall consist of an open heater, open cathode circuit, heater-cathode short, or heater-cathode leakage current in excess of the specified heater cycling life test end point limit.

Note 9: Envelope Temperature is defined as the highest temperature indicated when using a thermocouple #40 BS or smaller diameter elements welded to a ring of .025 inch diameter phosphor bronze placed in contact with the envelope. Envelope Temperature requirement will be satisfied if tube, having bogie Ib (±5%) under normal test conditions, is determined to operate at minimum specified temperature at any position on the life test rack.

Note 10: Stability Life Test: See 20.2.5.1 of Appendix C.

Note 11: Tubes shall be life tested at room temperature ambient.

Note 12: Test each unit separately.

Note 13: Tie 1k to 2k; 1g to 2g; and 1p to 2p.

Note 14: For Survival Rate Life Test, the equivalent Stability Life-Test conditions shall be as specified in 20.2.5.2.5 of Appendix C.

Note 15: Both units shall be operating.

Note 16: Intermittent Life Tests: See 20.2.5.3 of Appendix C.

Note 17: Survival Rate Life Test: See 20.2.5.2 to 20.2.5.2.4, inclusive, of Appendix C.

Note 18: An inoperative as referenced in Life Test is defined as a tube having one (1) or more of the following defects: discontinuity (Ref. MIL–E–1, par. 4.7.1), shorts, (Ref. MIL–E–1, par. 4.7.2), air leaks.

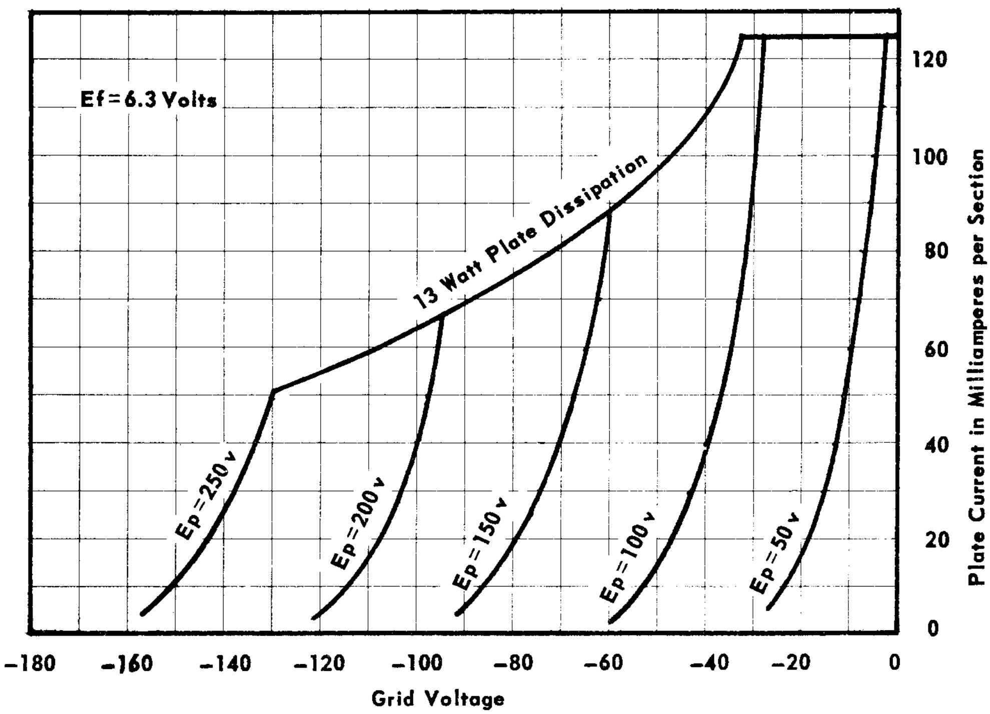
Note 19: All tests listed hereon shall be performed during qualification inspection; however, these three tests are normally performed during qualification inspection only.

Note 20: A common grid resistor of 0.1 megohm shall be added; however, this resistor shall not be used when a thyratron-type short indicator is employed.

RAYTHEON COMPANY · 55 Chapel Street · Newton 58, Massachusetts

RELIABLE TWIN POWER TRIODE

TRANSFER CHARACTERISTICS FOR EACH TRIODE SECTION



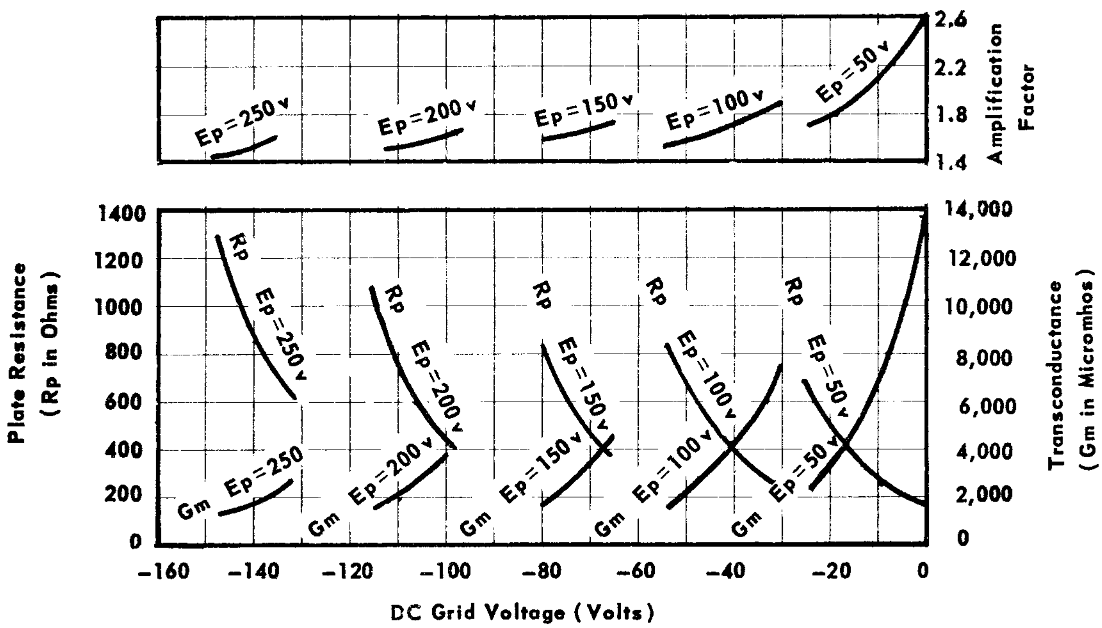


PLATE CHARACTERISTICS FOR EACH TRIODE SECTION

